ExxonMobil Chemical Europe Inc.
P.O. Box 105
1830 Machelen
Belgium
+32 2 722 22 24 Telephone
+32 2 722 22 99 Facsimile
melvyn.j.dew@exxonmobil.com

Melvyn J. Dew
Chief European Patent Attorney
Intellectual Property Law Shared Services

ExxonMobil

European Patent Office
Erhardstrasse 27
D-80469 MÜNCHEN
GERMANY

17 October 2005

International Patent Application No PCT/EP 2004/014475
ExxonMobil Chemical Patents Inc.
Our Ref: 2003B136/WO
RESPONSE TO WRITTEN OPINION OF THE ISA AND FILING OF DEMAND

Dear Sirs,

This communication responds to the Written Opinion of the International Searching Authority that accompanied the International Search Report dated 13 June 2005. In addition we are herewith filing the Demand, together with a Fee Sheet authorising payment of the Demand fee.

The applicants hereby request that a further Written Opinion be issued following substantive examination of the application, bearing in mind the following observations concerning Item V of the Written Opinion.

Where the application is referred to in this communication, reference is made to the text of the application as filed. The application was published on 30 June 2005 with International Publication Number WO 2005/058777 A1.

Amendments

The applicants file herewith amended page 32 which should replace page 32 as originally filed. This replacement page contains a new claim 1 replacing claim 1 as filed. Claims 2 to 22 remain unchanged and now depend, directly or indirectly, on the new claim 1.

Basis for the amendments in the application as filed

The amended claim 1 now specifies that the process of the invention is for a conversion reaction comprising the oligomerisation of olefins or the alkylation of aromatic or phenolic compounds with olefins. The basis for this amendment is to

Visiting address:
Hermeslaan 2, 1831 Machelen, Belgium
BTW-TVA: BE 407.625.474
HRB/RCB: 38 .301

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be found at several places in the description. By way of example, the limitation to the conversion process being an olefin oligomerisation reaction may be found at page 1, lines 4-5; while the basis for the conversion process being the alkylation reaction of aromatic or phenolic compounds with olefins may be found on page 1, line 5 and page 1, line 25.

In addition, amended claim 1 now specifies that the content of the feed is automatically controlled according to an analysis of the composition of the reaction feed. Basis for this amendment is to be found at page 8, line 13. Further support may be found, for example:

at page 12 lines 20 -21

"...variations in the proportions of reactive materials (such as olefins) and of diluents if (if any are used) ...";

and at page 14 lines 1-5

"... (determination of) the composition of the hydrocarbon feed...provides a breakdown of the feed's individual hydrocarbon components, typically the individual olefinic and paraffinic components. This composition is then available as the basis for calculating the water solubility of the feed stream..."

Clarity (Art 6 PCT)

Amended claim 1 overcomes the objection on clarity raised in the Written Opinion, since it now specifies that the invention relates to the oligomerisation of olefins or the alkylation of aromatic or phenolic compounds with olefins.

Sufficiency (Art 5 PCT)

Amended claim 1 also overcomes the objection on sufficiency raised in the Written Opinion. The application discloses the conversion products of the conversion reactions of the invention as now claimed. For example the oligomerisation reaction products are discussed at page 1, lines 9-12, and the alkylation reaction products are discussed at page 1, lines 25-28. Conversion conditions for these reactions are disclosed at various places throughout the application, for example at page 7, lines 9-20; at page 10, line 16 to page 11, line 5; at page 18, lines 16-17; at page 27, line 23 to page 28, line 13; and at page 29, line 16-30.

Novelty (Art 33(2) PCT)

Claim 1 of the application as filed was acknowledged to be novel according to Art 33(2) over the identified prior art, with the exception of D1 and D3. The amendments add features to the claim, so only novelty over D1 and D3 need be addressed.

Claim 1 as amended is novel over D1 because new claim 1 does not encompass the alkylation of **isoparaffins**, which is the subject of D1 (column 1, lines 17-18). Furthermore the disclosure of D1 is limited to an alkylation process that uses a **liquid** acid solution as catalyst. It teaches (col 1, lines 19-22) the involvement of an acid-hydrocarbon mixture. The hydrocarbon is separated from the acid in a settler, and there is recycling of a portion of the acid, and pumping of the acid (col 2, lines 37-38). Each of these elements implies that the catalyst is a liquid that is circulating and of which the acid strength is to be controlled (column 1, lines 15-17). D1 does not teach or suggest a process requiring a **bed** of catalyst as specified in amended claim 1.

Claim 1 as amended is novel over D3 because claim 1 requires the feed to pass through a **bed** of catalyst. The process taught in D3 involves a **liquid** phosphoric acid catalyst (column 1, lines 6-7). The reaction zone in D3 is packed with a bed of inert material (column 2, line 11) over which the catalyst and the reacting mixture is passed. Therefore, the process of D3 does not pass the feed over a bed of catalyst. Furthermore, amended claim 1 requires that the water content of the feed is automatically controlled according to an analysis of the composition of the **reaction** feed. In contrast, D3 is concerned only with the analysis of the **water content** of the feed, and water is not a reactant in the olefin conversion processes specified.

The subject matter of amended claim 1 is, therefore, novel over the prior art according to Art 33(2) PCT. Claims 2-22 are dependent on claim 1, and are therefore also novel over the prior art.

Inventive Step

The applicants agree with the Written Opinion that D2 can be considered as the closest prior art, as it is concerned with reactions belonging to the scope of the application at hand, and discusses the effect of feed water content on the performance of the catalyst.

Although D2 seeks to explain the impact of feed water content on the behaviour of olefin conversion processes, it necessarily employs laboratory and pilot unit experimentation methods. This leads to a difference between the teachings of D2 and the claimed invention which means that D2 does not provide a solution to the problems of industrial processes such as are addressed by the instant invention.

D2 certainly measures the water content of the feed and recognizes that this will have an affect on the acidity characteristics of the solid phosphoric acid catalyst employed. D2 also suggests to optimize the oligomerization process (see for example page 193, final paragraph) by changing the catalyst type or by drying the feedstock.

However, D2 uses pure propene feed for reasons of convenience (page 180, 4th paragraph), and is thus not concerned with feeds of varying compositions, unlike the process of the invention (page 9, lines 22-25). This exposes a key difference between D2 and the present application. The process of claim 1 controls the water content of the feed automatically according to an analysis of the **composition of the reaction feed**; whereas D2 (insofar as it suggests "control" rather than a simple one-off "adjustment" eg by changing the catalyst or using a dried feed) only teaches the reader to measure **water content**. The water content is only one element of the composition of the feed, and in any event, water is not a reactant in the olefin conversion processes to which the invention relates. It impacts on the nature of the catalyst, but is not itself a reactant in the oligomerisation or alkylation reactions.

The claimed invention is concerned with the problem of processing feeds that vary in composition, either desired or undesired (page 7, lines 6-8). Feedstock composition variations in terms of the proportions of different reactive ("reaction feed") materials and of diluents (if any are used), through differences in reactivity, affect catalyst activity and the reaction conditions, such as the size of the exotherm (page 7, lines 8-11). In order to maintain optimal reaction conditions, the inventive process therefore automatically changes the water level in the feed (page 7, lines 13-14) to account for changes in the reaction feed (hydrocarbon) composition as the process progresses. The hydration control system according to the invention enables compensation for these reaction feed changes (see page 12, lines 17-21), and therefore allows operation closer to the optimal reaction conditions.

This problem is not at all addressed by D2, since D2 uses for all its experiments "Either pure propene or a mixture of benzene and propene **(in the right relative amount)**", drawn from a pressurised cylinder (page 180, 2nd complete

paragraph). It is therefore inherent in D2 that D2 processes feedstocks of a constant composition, not varying in reaction feed composition but only possibly varying in terms of water content. D2 then concludes (page 195) that "rather fixed water contents in the feed are necessary" to give rise to the best catalytic performance. D2 therefore teaches away from adjusting the water content of the feed according to other variables (such as the reactants in the feed), which is the subject of the instant invention.

In conclusion, the problem addressed by the invention is one of how to account for variations in the composition of the reaction feed causing differences in the catalysed conversion process reactions, which on their terms require adjustment in feed water levels in order to operate the processes closer to their optimum. This problem is not recognised in the state of the art, and neither is the solution that the invention provides, i.e. to analyse the composition of the reaction feed and use the results for automatically guiding the control of the water content of the feed.

The applicants therefore submit that the subject matter of claim 1 is inventive over the prior art according to Art 33(3) PCT. Claims 2-22 are dependent on claim 1, and derive their inventiveness at least from this dependency.

Summary

The applicants submit that, for the reasons given above, the claimed invention is clearly defined, novel and inventive.

The applicants hereby request that any further Written Opinion to be issued by the IPEA takes account of the above arguments.

Please return Form 1037 to acknowledge receipt.

Yours faithfully,

Dew, Melvyn John
General Authorisation Number 11495

Encl.: Demand
Fee Sheet
Form 1037

The demand must be filed directly with the competent International Preliminary Examining Authority or, if two or more Authorities are competent, with the one chosen by the applicant. The full name or two-letter code of that Authority may be indicated by the applicant on the line below:

IPEA/ EP

PCT

CHAPTER II

DEMAND

under Article 31 of the Patent Cooperation Treaty:
The undersigned requests that the international application specified below be the subject of international preliminary examination according to the Patent Cooperation Treaty.

For International Preliminary Examining Authority use only

Identification of IPEA	Date of receipt of DEMAND

Box No. I IDENTIFICATION OF THE INTERNATIONAL APPLICATION

Applicant's or agent's file reference: 2003B136

International application No.	International filing date *(day/month/year)*	(Earliest) Priority date *(day/month/year)*
PCT/EP2004/014475	16 December 2004 (16/12/2004)	18 December 2003 (18/12/2003)

Title of invention
IMPROVEMENTS IN OR RELATING TO CATALYSED REACTIONS

Box No. II APPLICANT(S)

Name and address: *(Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country.)*

ExxonMobil Chemical Patents Inc.
5200 Bayway Drive
Baytown, TX 77520-5200
United States of America

Telephone No.

Facsimile No.

Teleprinter No.

Applicant's registration No. with the Office

State *(that is, country)* of nationality:	State *(that is, country)* of residence:
US	US

Name and address: *(Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country.)*

BEADLE, Stephen W.
36173 Bluff Oaks Avenue
Prairieville 70769
Louisiana
USA

State *(that is, country)* of nationality:	State *(that is, country)* of residence:
US	US

Name and address: *(Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country.)*

BROWN, Stephen H.
Avenue Albert Elizabeth 14
1200 Brussels
Belgium

State *(that is, country)* of nationality:	State *(that is, country)* of residence:
US	BE

[X] Further applicants are indicated on a continuation sheet.

International application No.
PCT/EP2004/014475

Continuation of Box No. II APPLICANT(S)

If none of the following sub-boxes is used, this sheet should not be included in the demand.

Name and address: *(Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country.)*

GODSMARK, John S.
Champs de Maubroux 18
1390 Grez Doiceau
Belgium

State *(that is, country)* of nationality:	State *(that is, country)* of residence:
GB	BE

Name and address: *(Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country.)*

MATHYS, Georges, M. K.
Eikenboomlaan 66
3360 Bierbeek
Belgium

State *(that is, country)* of nationality:	State *(that is, country)* of residence:
BE	BE

Name and address: *(Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country.)*

State *(that is, country)* of nationality:	State *(that is, country)* of residence:

Name and address: *(Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country.)*

State *(that is, country)* of nationality:	State *(that is, country)* of residence:

☐ Further applicants are indicated on another continuation sheet.

International application No.
PCT/EP2004/014475

Box No. III AGENT OR COMMON REPRESENTATIVE; OR ADDRESS FOR CORRESPONDENCE

The following person is [X] agent [ ] common representative

and [X] has been appointed earlier and represents the applicant(s) also for international preliminary examination.

[ ] is hereby appointed and any earlier appointment of (an) agent(s)/common representative is hereby revoked.

[ ] is hereby appointed, specifically for the procedure before the International Preliminary Examining Authority, in addition to the agent(s)/common representative appointed earlier.

Name and address: *(Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country.)*

DEW, Melvyn John
ExxonMobil Chemical Europe Inc.
PO Box 105
B-1830 Machelen
Belgium

Telephone No.
+32 2 722 22 24

Facsimile No.
+32 2 722 22 99

Teleprinter No.

Agent's registration No. with the Office
11495

[ ] **Address for correspondence:** Mark this check-box where no agent or common representative is/has been appointed and the space above is used instead to indicate a special address to which correspondence should be sent.

Box No. IV BASIS FOR INTERNATIONAL PRELIMINARY EXAMINATION

Statement concerning amendments:*

1. The applicant wishes the international preliminary examination **to start on the basis of:**

[X] the international application as originally filed

the description
- [X] as originally filed
- [ ] as amended under Article 34

the claims
- [ ] as originally filed
- [ ] as amended under Article 19 (together with any accompanying statement)
- [X] as amended under Article 34

the drawings
- [X] as originally filed
- [ ] as amended under Article 34

2. [ ] The applicant wishes any amendment to the claims under Article 19 to be considered as reversed.

3. [ ] Where the IPEA wishes to start the international preliminary examination at the same time as the international search in accordance with Rule 69.1(b), the applicant requests the IPEA **to postpone** the start of the international preliminary examination until the expiration of the applicable time limit under Rule 69.1(d).

4. [X] The applicant expressly wishes the international preliminary examination **to start earlier** than at the expiration of the applicable time limit under Rule 54*bis*.1(a).

* Where no check-box is marked, international preliminary examination will start on the basis of the international application as originally filed or, where a copy of amendments to the claims under Article 19 and/or amendments of the international application under Article 34 are received by the International Preliminary Examining Authority before it has begun to draw up a written opinion or the international preliminary examination report, as so amended.

Language for the purposes of international preliminary examination: English

- [X] which is the language in which the international application was filed.
- [ ] which is the language of a translation furnished for the purposes of international search.
- [ ] which is the language of publication of the international application.
- [ ] which is the language of the translation (to be) furnished for the purposes of international preliminary examination.

Box No. V ELECTION OF STATES

The filing of this demand constitutes the election of all Contracting States which are designated and are bound by Chapter II of the PCT.

Sheet No. ..4

International application No.
PCT/EP2004/014475

Box No. VI CHECK LIST

The demand is accompanied by the following elements, in the language referred to in Box No. IV, for the purposes of international preliminary examination:				For International Preliminary Examining Authority use only: received	For International Preliminary Examining Authority use only: not received
1. translation of international application	:		sheets	☐	☐
2. amendments under Article 34	:	1	sheets	☐	☐
3. copy (or, where required, translation) of amendments under Article 19	:		sheets	☐	☐
4. copy (or, where required, translation) of statement under Article 19	:		sheets	☐	☐
5. letter	:		sheets	☐	☐
6. other *(specify)* Form 1037	:	2	sheets	☐	☐

The demand is also accompanied by the item(s) marked below:

1. ☒ fee calculation sheet
2. ☐ original separate power of attorney
3. ☐ original general power of attorney
4. ☐ copy of general power of attorney; reference number, if any:
5. ☐ statement explaining lack of signature
6. ☐ sequence listing in electronic form
7. ☐ tables in electronic form related to a sequence listing
8. ☒ other *(specify)*: Response to ISA Written Opinion

Box No. VII SIGNATURE OF APPLICANT, AGENT OR COMMON REPRESENTATIVE

Next to each signature, indicate the name of the person signing and the capacity in which the person signs (if such capacity is not obvious from reading the demand).

DEW, Melvyn John
GA No 11495

For International Preliminary Examining Authority use only

1. Date of actual receipt of DEMAND:

2. Adjusted date of receipt of demand due to CORRECTIONS under Rule 60.1(b):

3. ☐ The date of receipt of the demand is AFTER the expiration of 19 months from the priority date and item 4 or 5, below, does not apply.
   ☐ The applicant has been informed accordingly.
4. ☐ The date of receipt of the demand is WITHIN the time limit of 19 months from the priority date as extended by virtue of Rule 80.5.
5. ☐ Although the date of receipt of the demand is after the expiration of 19 months from the priority date, the delay in arrival is EXCUSED pursuant to Rule 82.
6. ☐ The date of receipt of the demand is AFTER the expiration of the time limit under Rule 54*bis*.1(a) and item 7 or 8, below, does not apply.
7. ☐ The date of receipt of the demand is WITHIN the time limit under Rule 54*bis*.1(a) as extended by virtue of Rule 80.5.
8. ☐ Although the date of receipt of the demand is after the expiration of the time limit under Rule 54*bis*.1(a), the delay in arrival is EXCUSED pursuant to Rule 82.

For International Bureau use only

Demand received from IPEA on:

See Notes to the demand form

cc MAA

CHAPTER II

PCT

FEE CALCULATION SHEET

Annex to the Demand

International application No. PCT/EP2004/014475	For International Preliminary Examining Authority use only
Applicant's or agent's file reference 2003B136	Date stamp of the IPEA

Applicant

ExxonMobil Chemical Patents Inc.

CALCULATION OF PRESCRIBED FEES

1. Preliminary examination fee	1530.00 P	
2. Handling fee *(Applicants from certain States are entitled to a reduction of 75% of the handling fee. Where the applicant is (or all applicants are) so entitled, the amount to be entered at H is 25% of the handling fee.)*	129.00 H	
3. Total of prescribed fees Add the amounts entered at P and H and enter total in the TOTAL box	1659.00 TOTAL	

MODE OF PAYMENT

- [x] authorization to charge deposit account with the IPEA (see below)
- [ ] cash
- [ ] cheque
- [ ] revenue stamps
- [ ] postal money order
- [ ] coupons
- [ ] bank draft
- [ ] other *(specify)*:

AUTHORIZATION TO CHARGE (OR CREDIT) DEPOSIT ACCOUNT

(This mode of payment may not be available at all IPEAs)

IPEA/ EP

- [x] Authorization to charge the total fees indicated above.
- [ ] *(This check-box may be marked only if the conditions for deposit accounts of the IPEA so permit)* Authorization to charge any deficiency or credit any overpayment in the total fees indicated above.

Deposit Account No.: 28300203

Date: 17 October 2005

Name: DEW, Melvyn John

Signature: Melvyn J Dew

See Notes to the fee calculation sheet

CLAIMS

1. A process for the conversion of olefins in which the conversion reaction comprises the oligomerisation of olefins or the alkylation of aromatic or phenolic compounds with olefins in a reactor, which comprises continuously passing a feed comprising an olefin and water through a bed of catalyst under conversion conditions to form a conversion product, the water content of the feed being automatically controlled according to an analysis of the composition of the reaction feed.

2. The process according to claim 1 in which the water is introduced into the feed by means of a water wash.

3. The process according to claim 2 in which one or more coalescers are provided downstream of the water wash.

4. The process according to any preceding claim wherein the water content of the feed is automatically controlled in dependence on the results of the analysis by one or more of (a) introducing water into the feed, (b) drying the feed and (c), in the case where a water wash is used, adjusting the temperature of the water wash.

5. The process according to any of the preceding claims wherein an on-line analyser is provided to determine the composition of the feed as it is fed to the reactor.

6. The process according to any of the preceding claims in which the analysis of the reactor feed also includes a measure of the concentration of oxygenated components.

7. The process according to any of the preceding claims wherein the water content of the feed is controlled to be greater during the initial phase of the process than the latter phase of the process.

8. The process according to any of the preceding claims in which the conversion products are separated from unreacted olefins and diluent (if any).